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API 8025

instruction manual

NORTH ATLANTIC
industries, inc.

Model API - 8025

instrument servos

OPERATING AND INSTRUCTION MANUAL

MODEL API-8025 S-552

ANGLE POSITION INDICATOR

NORTH ATLANTIC INDUSTRIES, INC.
Plainview New York

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SECTION I

GENERAL INFORMATION

Description

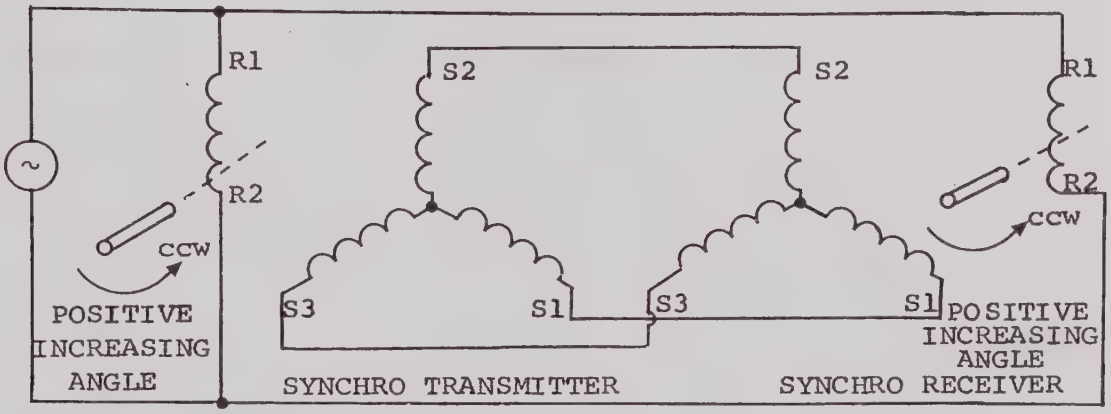
The North Atlantic Industries Model API-8025 Angle Position Indicator is a servo device that quickly and accurately displays the angular shaft position of remote data transmitters. Continuous digital readout in degrees and minutes is displayed on the front panel counter.

The rugged half-rack unit features plug-in modular solid-state components. The highly stable components used allow rapid, precise measurement without manipulation of operating controls.

Definitions and Conventions

The API-8025 can be considered as though it were a synchro receiver for connection purposes, per Mil-S-20708A. Figure 3.3 shows a schematic diagram of a synchro receiver connected to a synchro transmitter both pictured at electrical zero. Electrical signals from the synchro transmitter are

connected to the receiver's stator leads. The receiver's rotor is excited from the same source and of the same phase as the transmitter's rotor. Turning the synchro transmitter shaft counterclockwise (as viewed from the shaft end) results in increasing positive electrical data being fed to the receiver. The receiver shaft then turns counterclockwise to produce a corresponding, increasing positive shaft angle.



TYPICAL SYNCHRO SYSTEM

Figure 1.1

Specifications for Model 8025-S552, S654

Input Form:	11.8 volts, line to line, 400~ synchro
Display:	Digital counter reading degrees and minutes. 1 minute graduations (readable to 30 sec.)
Range:	0^{o} - 360^{o} continuous rotation.
Accuracy:	± 6 minutes of arc
Repeatability:	± 30 seconds of arc
Slew Speed:	25 degrees per second
Power Requirements:	115V, 400~ @ 200 ma slew 170 ma quiescent
	Internal -28 volts DC power supply
Physical Dimensions:	Height: 1-3/4" Width: 9-1/2" Depth: 9" Mounting: Half rack Weight: 3-1/2 lbs. approximate.

SECTION II

INSTALLATION

Removal From Shipping Container

This instrument has been thoroughly tested, inspected, and evaluated at the factory prior to shipment. Particular care has been taken in the design of the special wrapping and packaging material used in the container to ensure that no damage results from the typical handling encountered during shipment. However, upon removal from package, the instrument should be externally inspected for any obvious damage. Should such be observed, refer to Warranty Policy for procedure to follow.

Rack Installation

Mount the API-8025 in the half-rack using the standard 10-32 rack mounting hardware. The API may be mounted in any physical position.

Cooling

API-8025's may be stacked in the half-rack as closely as the front panels allow. The instrument's design assures enough clearance for free air circulation. Care should be taken to ensure adequate circulation of air in enclosed racks.

Power Requirements

Refer to the Specifications Sheet on Page 1.3.

Operating Procedure

With the API female mating connector wired in accordance with the cabling instructions in the preceding section, the unit may be checked for proper operation. Turn unit on, and note that the API slews to a reading. Zero Data Transmitter with the Data Receiver within the API.

Turn the transmitter to several angles throughout the 360° range and check counter readout for coincidence.

The counter should change in the same direction as the transmitter and at a rate as outlined in the specifications for slew speed on Page 1.3.

If the API-8025 contains more than 1 data receiver, the above procedure should be followed for each data receiver.

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SECTION III

THEORY OF OPERATION

General Discussion

The API-8025 is a closed loop instrument servo system that is activated by electrical error signals. The electrical error signals are derived by comparing the actual position of the Data Receiver with the desired position as commanded by the electrical data input.

The error signal, which carries both amplitude and direction information, is amplified and phase corrected by the Servo Amplifier.

The servo motor fixed (or reference) phase is energized from the same signal source as the Data Transmitter. The control and signal phase receive the amplified error signal delivered by the Servo Amplifier. The speed of the servo motor is proportional to the error signal amplitude while the direction of rotation of the motor depends on the phase of the control field signal.

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The Gear Train, powered by the Servo Motor, provides driving power for all rotary components in the system. The high precision gears and shafting are ball bearing supported at each end by parallel end plates. Split anti-backlash gears are used in the gear passes at the Data Receiver in order to minimize backlash errors.

The angular position of the Data Receiver is displayed on the panel mounted counter. The counter is geared such that one revolution of the Data Receiver results in 360° excursion of the counter.

An electrical network is incorporated in the Servo Motor fixed (or reference) phase to damp out any severe overshoots caused by inertia of the rotating components.

SECTION III

FUNCTIONAL SCHEMATIC

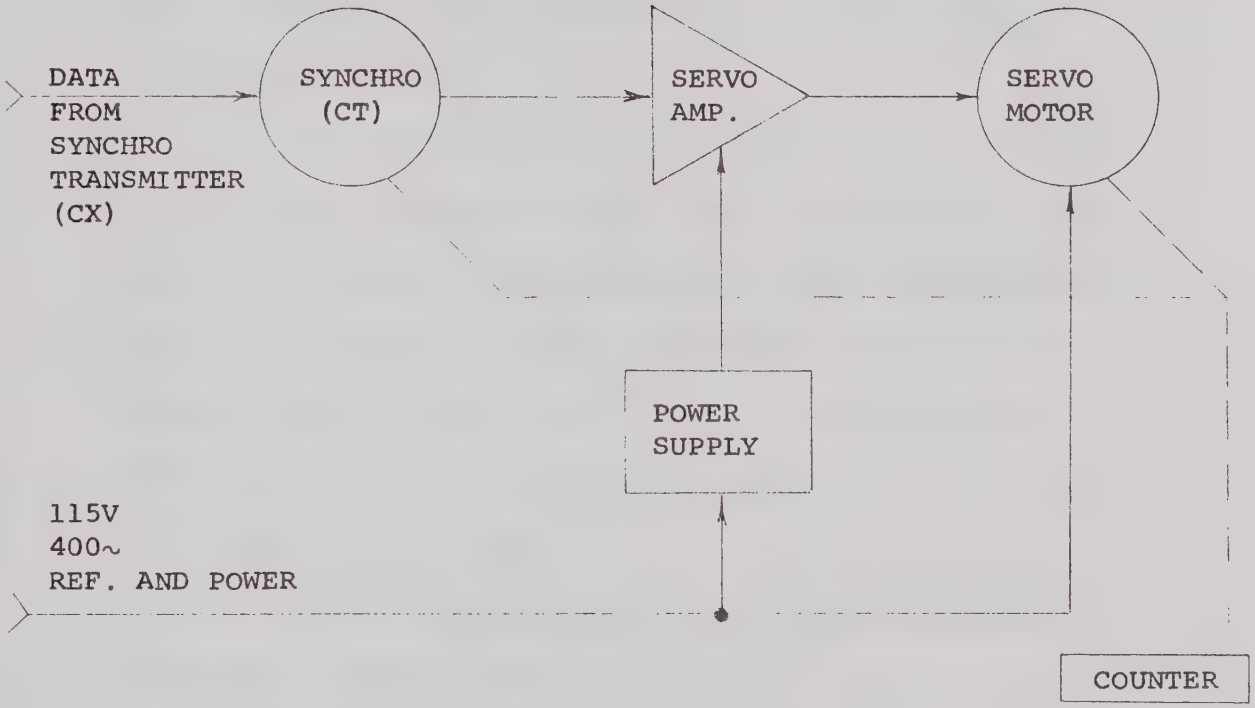

FIGURE 3.1A

MODEL 8025 ANGLE POSITION INDICATOR

Gear Train

The Gear Train consists of a flat ground plate securely doweled to a precision machined aluminum casting. This assembly is then line bored to minimize errors due to non-parallel shafts.

All gearing is of AGMA Quality No. 12, backlash "D" per AGMA Bulletin 390.01 and all ball bearings are ABEC-7 grade. All pinions and shafting are made from stainless steel and mesh with aluminum gears for long life. The counter gear is hobbed from "Delrin" acetal resin for extra long life, low inertia, and quiet mesh under adverse environmental conditions.

The last two gears are anti-backlash gears. This allows for a total gearing error of less than 1 minute of arc when measured at the shaft of the Data Receiver.

The geared assembly is so designed such that other Data Receivers may be mounted at either one speed or other convenient multiples thereof.

The entire Gear Train is covered and all bearings are shielded to prevent entrance of dirt and dust. Careful assembly and sound design in selection of materials allows this unit to meet the requirements of all applicable Military Standards.

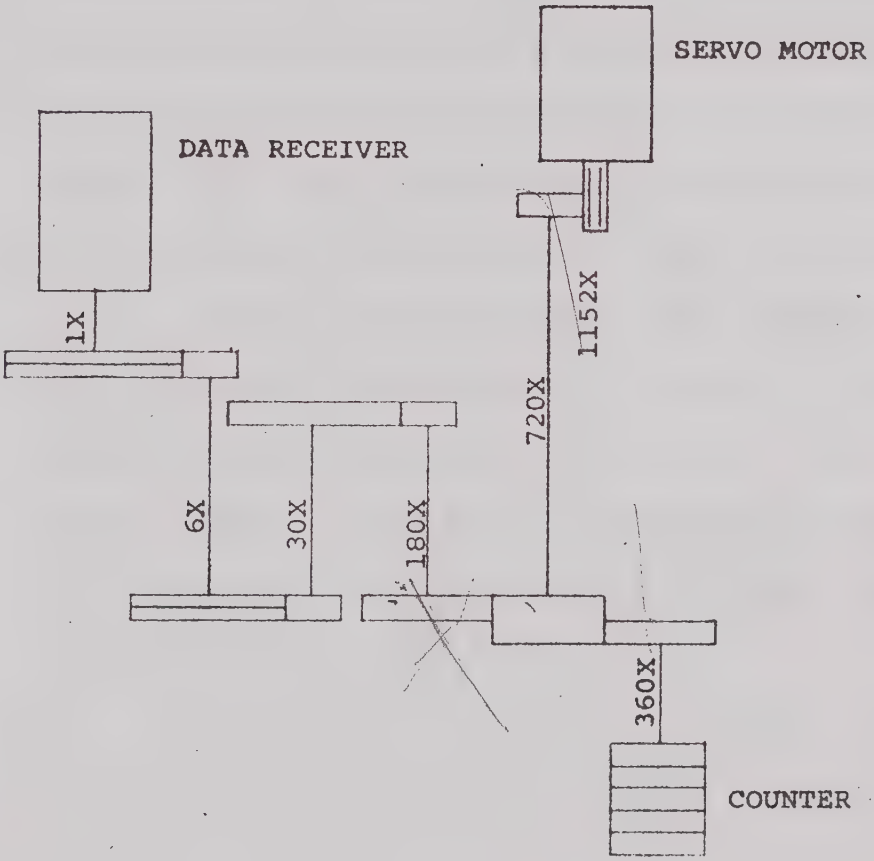

Figure 3.2

GEAR SCHEMATIC

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Counter

The counter used in API-8025 is a unique design which can be driven at higher speeds than previous counters. This is achieved through the use of a geneva transfer mechanism between the minute wheel and the units of degrees wheel. The geneva assures smooth transition between digits and reflects smaller peak torque loads back to the Gear Train. Further torque reductions and smoothness of operation is achieved by incorporating the hundreds of degrees and tens of degrees digits on a fabric tape. Ball bearings, teflon idlers, delrin wheels, and stainless steel shafting further combine to insure smooth, error-free transitions from number to number.

Servo Amplifier

The modular printed circuit Servo Amplifier used in API-8025 is a solid-state, push pull design. Local feedback is incorporated to decrease the effects of individual transistor characteristics on the amplifier performance.

Adequate decoupling and built-in Zener regulation are provided to insure smooth amplifier operation from poorly regulated external power supplies. The amplifier specifications are as follows:

Input Voltage:	0-50V RMS, 400~
Input Impedance:	12K ohms, ± 10%
Gain:	1,500 ± 20%
Phase Shift:	$15^{o} \pm 10^{o}$
Output Load:	Size 11, 400~ ct. motor with 225Ω nominal control field impedance.
Maximum Output Voltage:	36V ± 10%
Noise at Output (Input Shorted)	50mv RMS Maximum
Power Required:	-28V D.C. ± 10% @ 300ma ± 20%

Power Supply

The modular printed circuit Power Supply used in API-8025 is an all solid-state design with an emitter follower buffered output. Silicon rectifiers in a full wave bridge circuit supply power to the filter and buffer section. The removal of this Power Supply is optional for users with -28V DC power available. The Power Supply specifications are as follows:

Output Voltage: (Full Load)	-28V DC ± 10%
Full Load Current:	300ma ± 10%
Input Voltage:	26V RMS ± 10%
Input Frequency:	400~ ± 20%
Output Voltage: (No Load)	-32V DC ± 10%
Output Ripple: (Full Load)	500mv P-P Max.

Data Receiver

The Data Receiver mounted in the API-8025 is a size 11, 11.8 volts, line-to-line synchro. The operating characteristics of this Data Receiver are listed below:

Size:	11
Frequency (cps):	400
Input Voltage: (Line to Line)	11.8
Input Power (Watts):	.03
Input Impedance:	$577/81^{\circ}$

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SECTION IV

MAINTENANCE

General

In operation, the API-8025 is virtually maintenance free. The precision Gear Train is permanently lubricated and requires no adjustment or cleaning. If replacement of major components should become necessary, the instrument will require recalibration following the procedure set forth in the Calibration Section which follows.

Required Test Equipment

Resolver-Synchro Simulator - NAI Model 530.

Calibration

1. Connect API-8025 to Resolver-Synchro Simulator per Figure 4.1. Select Resolver or Synchro Mode and select proper signal input voltage.
2. Turn on power.
3. Set Resolver-Synchro Simulator for 000.000° and record reading on API-8025.

4. Advance Resolver-Synchro Simulator in 5° steps and record readings.

5. Review data and check intermediate points approaching error limit.

6. Compute error spread.

7. Re-align the Data Receiver, if necessary, by loosening locking clamps and rotating Data Receiver to centralize error.

8. Tighten locking clamps.

9. Repeat Steps 3 through 6.

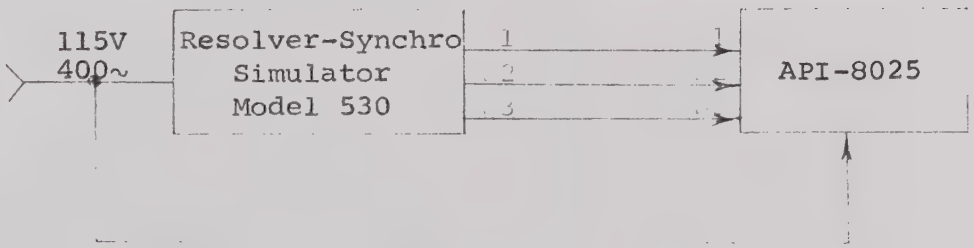

Figure 4.1

SCHEMATIC

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REPLACEMENT PARTS LIST

Part	Circuit Symbol	Vendor and P/N	Value	NAI Part No.
Fuse	F1,F2	Bussman Mfg. P/N GMW 1/2	1/2 Amp.	802398
Pilot Lamp	I1	Dialight Corp. P/N 1829	28V	802383
Servo Motor	B1	North Atlantic Industries		801319
Data Receiver	B2	North Atlantic Industries	11.8V Synchro	802552
Servo Amp.	A1	North Atlantic Industries		782084
Resistor	R1	Dale Electronic Inc. P/N B10-1K-10W-10%	1K, 10W	802390
Rectifier	CR1	1N645		800323
Capacitor	C1	Sprague Electric P/N 150D56SX9035B2	5.6uf,35VDC	802391

CAUTION

High voltage exists at several points in the instrument. Normal precautions consistent with good practice should be taken to reduce shock hazard.

A potential shock hazard exists when ungrounded power source or ungrounded case operation is employed. Persons operating the instrument should be made aware of and take precautions against this condition.

North Atlantic Industries, Inc. cannot be held responsible for damage to person or property in the process of or as a result of maintenance, calibration, or setting up of the instrument.

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WARRANTY

North Atlantic Industries, Inc. warrants its products against defects in material and workmanship for one year from the date of the original shipment. Our liability is limited to repairing or replacing products (except fuses and electron tubes) which prove to be defective during the warranty period.

North Atlantic Industries, Inc. is not liable for consequential damages or for any damage or injury to persons or property resulting from the operation or application of any of its equipment.

Warranty is voided if there is evidence that the product has been operated beyond its design range, improperly maintained, or physically mistreated.

In the event of a malfunction in a product under warranty, the purchaser should notify his local Sales Representative or the Sales Department of North Atlantic Industries, Inc. giving full details of the defect and providing the model and serial number of the instrument. Service data or shipping instructions will be forwarded promptly. There is no charge for warranty repair of products, except transportation charges.

North Atlantic Industries, Inc. reserves the right to make changes and improvements in its products without any liability for incorporating such changes or improvements in any products previously sold.

No other warranty expressed or implied is offered other than the foregoing.

Estimates of charges for out of warranty repairs or other service work will be supplied before work begins. Out of warranty repairs will only be made following the receipt of purchaser's authorization of applicable charges.

Claims for Damage in Shipment

The purchaser should inspect and functionally test the product in accordance with the instruction manual as soon as it is received. If the product is damaged in any way, including concealed damage, a claim should be filed immediately with the carrier, or, if insured separately, with the purchaser's insurance company.

(turn over for Shipping Instructions)

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